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NOTES ON GEOGRAPHIC DISTRIBUTION

Unexpected discovery of the Australian seed bug *Brentiscerus putoni* (White, 1878) (Hemiptera, Heteroptera, Lygaeoidea, Rhyparochromidae, Drymini) in Japan suggests the possibility of a recent introduction due to human activity

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Abstract. The genus *Brentiscerus* Scudder, 1962 (Hemiptera, Heteroptera, Lygaeoidea, Rhyparochromidae, Drymini) is widely distributed in the Australian Region; however, no species have been recorded in the Palaearctic Region. Here, we report *Brentiscerus putoni* (White, 1878) from Japan, based on materials collected from Honshu, Kyushu, and Kamikoshiki-shima Island. This discovery represents the first Palaearctic record of the genus and suggests that *B. putoni* may be an alien species in Japan. All 25 specimens were collected in a well-investigated region of Japan since 2013.

Keywords. Alien species, Honshu, Kamikoshiki-shima Island, Kyushu, new records, Palaearctic region

Ban T, Souma J, Hisasue Y (2024) Unexpected discovery of the Australian seed bug *Brentiscerus putoni* (White, 1878) (Hemiptera, Heteroptera, Lygaeoidea, Rhyparochromidae, Drymini) in Japan suggests the possibility of a recent introduction due to human activity. Check List 20 (3): 622–629. https://doi.org/10.15560/20.3.622

INTRODUCTION

Over the past decade, several alien hemipteran species have been reported in Japan (Yasunaga et al. 2016; Research Group of the Alien Cicada 2017; Nakatani et al. 2019; Ban and Nakamura 2020; Sugimoto 2020; Hasegawa et al. 2022; Sasaki 2023). Recently, an indeterminate species of seed bug was collected from the western Honshu, Kyushu, and Kamikoshiki-shima Island, which are in the Palaearctic part of Japan, mainly by two of us (J. Souma and Y. Hisasue). This species has been collected from residential areas, university campus, and grasslands in riverbeds surrounded by mountainous forests since 2013 (Ito et al. 2020; present study). After a careful morphological examination, especially of the body length, the ground color of the posterior lobe of the pronotum, and the coloration of the leg, we conclude that these specimens correspond to *Brentiscerus putoni* (White, 1878).

Brentiscerus putoni is one of two known species of the genus *Brentiscerus* Scudder, 1962 (Hemiptera, Heteroptera, Rhyparochromidae, Drymini) and is distributed in the following countries in the Australian Region: New Zealand, Australia, part of Indonesia, and Papua New Guinea (Dellapé and Henry 2022). To date, in New Zealand, *B. putoni* is known to occur in lowlands to mountainous areas, where it has been collected from moss and leaf litter in *Nothofagus* Blume forests, grasslands, and weedy areas composed of *Ozothamnus* R. Br. – *Aciphylla* J.R. Forster & G. Forster vegetation and *Acaena novae-zelandiae* Kirk. vegetation, as well as under lichens on rock faces and along stream banks (Larivière and Larochelle 2004). In other words, *B. putoni* is considered a common species in New Zealand. However, this genus has not been reported from other biogeographical regions. Therefore, the discovery of *B. putoni* in the Palaearctic part of Japan was unexpected.

In this study, we provide the first record of the genus *Brentiscerus* in Japan and the Palaearctic Region, based on *B. putoni*. The possibility that *B. putoni* is an alien species in Japan is also discussed.

OPEN ACCESS

Academic editor: Hélcio Gil-Santana
Received: 10 February 2024
Accepted: 25 April 2024
Published: 14 May 2024

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METHODS

Dried specimens were used in this study. To observe the genitalia, the male and female abdomens were removed from the body after softening the specimens using steam. The removed parts were immersed in a hot 10% KOH solution for 1 h and then soaked in distilled water for further dissection. Parameres were removed from the male genital capsule using tweezers. The internal contents were cleared after thoroughly washing in distilled water two or three times before dissection of the terminalia and spermathecae. The external morphology was observed under a stereoscopic microscope (Olympus SZ40 and Olympus SZX12). The genitalia were observed and drawn under a light microscope (Nikon Optiphot and Olympus BH-2) using a drawing tube. The genitalia were preserved in small glass tubes containing glycerin and mounted on a pin with the respective specimen. Photographs of the specimens (Figure 1) were captured using a digital camera (Canon EOS 5D Mark IV) with a Canon MP-E 65 mm f/2.8 1–5× macro lens . Photographs were focus-stacked using the Zerene Stacker image stacking software. Living individuals were photographed using a Nikon D5200 digital camera and lens with an AF-S DX Micro Nikkor 40 mm f/2.8G lens. The habitats (Figure 3) were photographed using an Olympus TG-5 digital camera. The distribution of the new species was mapped using SimpleMappr (Shorthouse 2010). All illustrations, photographs, and images were edited using Adobe Photoshop CC.

Measurements were performed using a micrometer on an eyepiece grid. All measurements in the text are given in millimeters. The morphological terminology follows that reported by Ban (2022) and Salini and Kment (2021).

The specimen depositories were abbreviated as follows: **CBM**, Natural History Museum and Institute, Chiba, Japan; **ELKU**, Entomological Laboratory of Kyushu University, Fukuoka, Japan.

RESULTS

The genus *Brentiscerus* and *B. putoni* are recorded in Japan for the first time, based on 25 specimens collected from Honshu, Kyushu, and Kamikoshiki-shima Island.

Genus *Brentiscerus* Scudder, 1962

Identification. *Brentiscerus* is distinguished from other rhyparochromid genera by the following characteristics: head dark brown to black, covered with distinct punctures; antennal tubercles visible from above; anterior lobe of pronotum dark brown to black; pronotum with anterior collar; lateral margin of pronotum with white carinate, slightly concave at middle; posterior margin slightly concave; disc with a transverse impression at middle; scutellum with trifurcate shaped carina at middle; profemur moderately expanded, armed with a large spine near middle and smaller spines more apically; hemelytra with apical margin straight, anterior margin slightly convex in apical half and impressed basally; corium with dark-brown spot at middle and apex of corium; and lateral margin of corium weakly sinuate (Scudder 1962; present study). The recorded specimens matched these diagnostic characteristics (Figures 1–3) and were identified as *Brentiscerus* without uncertainty.

Brentiscerus putoni (White, 1878)

Figures 1–3

New records. JAPAN – **Honshu** • Aichi Pref., Aizai-shi, Hayao-chô; 2.X.2022; Tomohide Ohno leg.; 1 ♀, CBM-ZI 189936 • Okayama Pref., Okayama-shi, Kita-ku, Nakai-chô; 34°40′51.3″N, 133°55′58.4″E; 20.V.2022; Jun Souma leg.; 1 ♀, CBM-ZI 189937 • Hiroshima Pref., Hiroshima-shi, Saeki-ku, Shinguen; 19.XII.2020; Hayato Bando leg.; artificial light; 1 ♂, CBM-ZI 189938 – **Kyushu** • Fukuoka Pref., Kitakyushu-shi, Yahatahigashi-ku, Kiyota, Yahata High School; 6.VII.2013; S. Okudera leg.; 1 ♀, CBM–ZI 189939 • Fukuoka Pref., Asakura-shi, Komo, near Chikugo River; 33°22′21.8″N, 130°43′36.4″E; 14.V.2022, Jun Souma leg.; 1 ♂, CBM-ZI 189940 • Fukuoka Pref., Asakura-shi, Naka, Chikugo-gawa River; 33°21′46.3″N, 130°40′47.2″E; 2.XII.2021; Yu Hisasue leg.; Tullgren; 1 ♀, CBM–ZI 189941 • Fukuoka Pref., Kasuya-gun, Sasaguri-machi, Tsubakuro; 2.VII.2020; Yu Hisasue leg.; light trap; 1 ♀, ELKU • Fukuoka Pref., Fukuoka-shi, Nishi-ku, Izumi; 33°34′47.27″N, 130°14′26.88″E; 10.VI.2021; Yu Hisasue leg.; artificial light; 1♀, ELKU • Fukuoka Pref., Fukuoka-shi, Nishi-ku, Fujimi; 33°34′51.6″N, 130°14′23.28″E; 2.VI.2021; Yu Hisasue leg.; artificial light; 1 ♀, ELKU • as above but 7.VI.2021; Yu Hisasue leg.; artificial light; 1 ♂, ELKU • as above but 10.VI.2021; Yu Hisasue leg.; artificial light; 1 ♂, 5 ♀, ELKU • as above but 12.VI.2021; Jun Souma leg.; artificial light; 2 ♀, ELKU • as above but 15.VI.2022; Yu Hisasue leg.; artificial light; 1 ♂, 1 ♀, ELKU. • as above but 17. VI. 2022; Yu Hisasue leg.; Artificial Light; 1 ♀, ELKU. • Fukuoka Pref., Fukuoka-shi, Nishi-ku, Motohama; 33°35′29.6″N, 130°13′28.7″E; 12. VI. 2021; Jun Souma leg.; artificial light; 1 ♂, 1 ♀, ELKU • Fukuoka Pref., Fukuoka-shi, Nishi-ku, Kuwabara, Kyushu University; 28.V.2021; Yu Hisasue & Natsumi Katsube leg.; Tullgren; 1 ♀, ELKU – **Kamikoshiki-shima Island** • Kagoshima Pref., Kamikoshiki-shima Is., Mt. Tomeki-yama; 25.VI.2019; Shoichi Imasaka leg.; 1 ♂, CBM-ZI 190000 (referring to Ito et al. 2020).

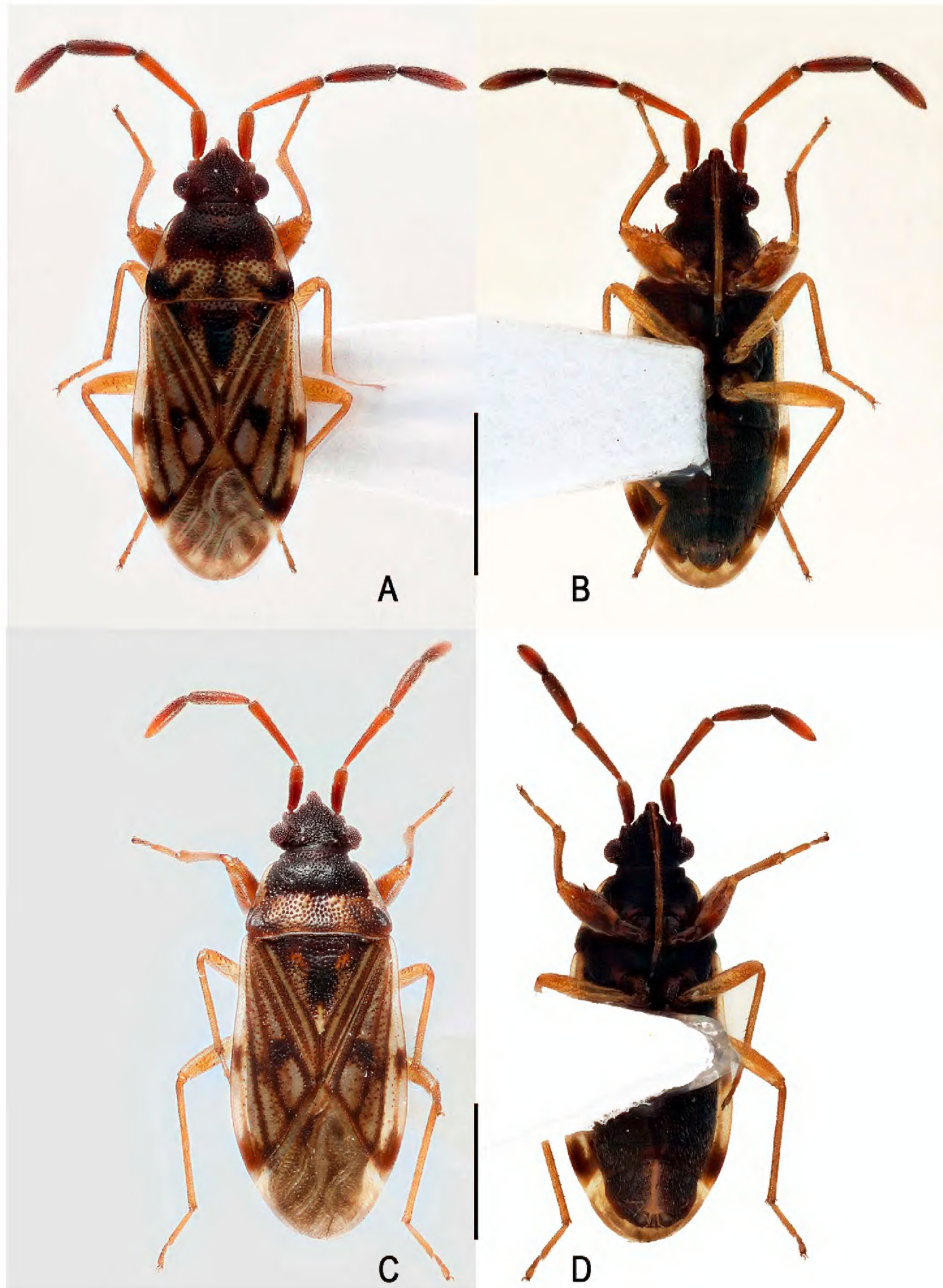

Figure 1. *Brentiscerus putoni* from Japan. **A.** Male, dorsal view. **B.** Male, ventral view. **C.** Female, dorsal view. **D.** Female, ventral view. Scale bars: 1.0 mm.

Identification. *Brentiscerus putoni* can be distinguished from its only congener, *B. obscurus*, by a combination of the following characteristics (Gross 1965; Malipatil 1975, 1977): body length less than 3.3 mm (vs. more than 3.5 mm); ground color of posterior lobe of pronotum yellowish brown, with blackish maculation (vs. uniformly dark reddish brown); legs yellowish brown (vs. reddish brown).

Twenty-five specimens from Japan (Figure 1) matched well with the lectotype, non-type specimens collected from New Zealand, descriptions (White 1878; Bergroth 1916; Malipatil 1977; Kondorosy 2013), and illustrations (Malipatil 1977) of *B. putoni* in terms of the morphological characteristics. Therefore, the specimens from Japan were identified as *B. putoni*.

A seed bug species earlier recorded from Kamikoshiki-shima Island, Japan as "*Scolopostethus* sp." by Ito et al. (2020) is also *B. putoni*.

Distribution. Japan (Honshu, Kyushu, Kamikoshiki-shima Island) (Figures 4, 5) (Ito et al. 2020; present study); Indonesia (Java, Bali, Flores, Sumba) (Bergroth 1916; Slater 1964; Kondorosy 2013; Dellapé and Henry 2022); Papua New Guinea (Kondorosy 2013; Dellapé and Henry 2022); Australia (Bergroth 1916; Slater 1964; Cassis and Gross 2002; Kondorosy 2013; Dellapé and Henry 2022); New Zealand (North Island, South Island, Chatam Island, Three Kings Island) (White 1878; Slater 1964; Scudder 1967; Malipatil 1975; Malipatil 1977; Cassis and Gross 2002; Larivière and Larochelle 2004; Kondorosy 2013; Dellapé and Henry 2022).

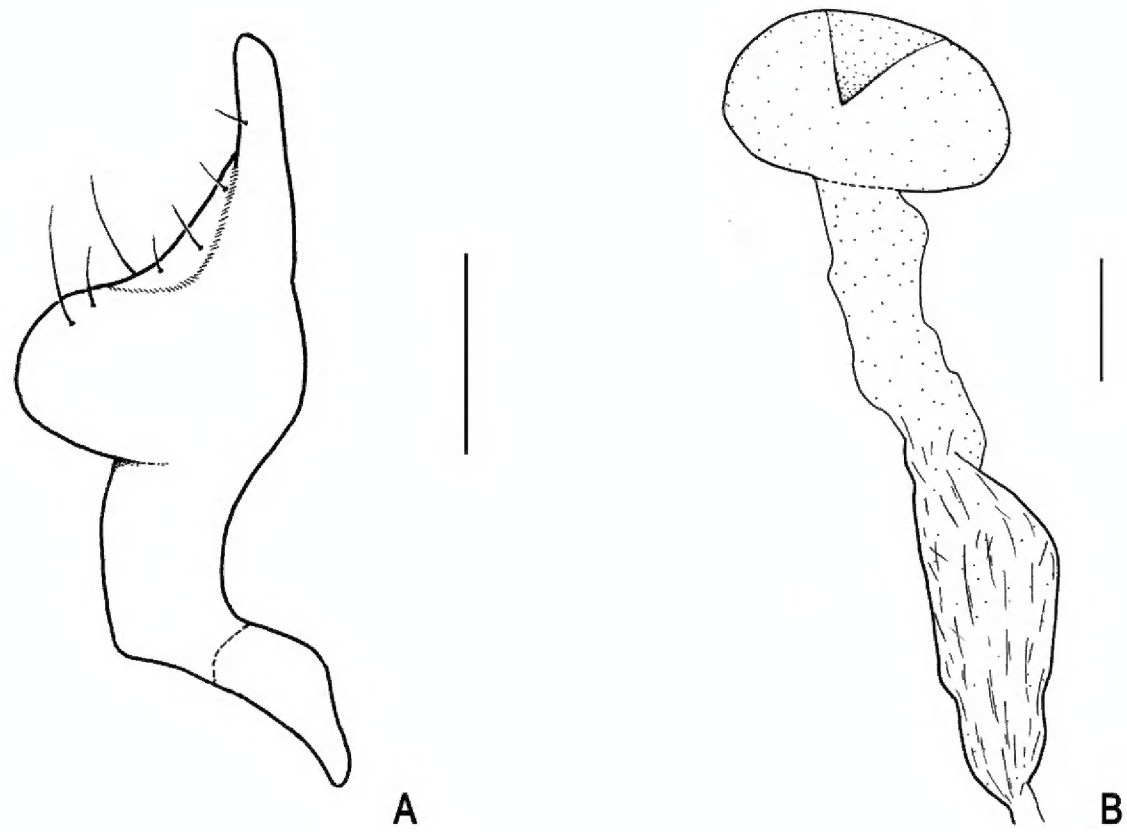

Figure 2. *Brentiscerus putoni* from Japan. **A.** Left paramere, dorsal view. **B.** Spermatheca. Scale bars: 0.01 mm.

Figure 3. *Brentiscerus putoni* from Japan. **A.** Living adult. **B.** Living adult, sucking spikelet of *Briza minor*. **C, D.** Habitats of *Brentiscerus putoni* near Chikugo River, Asakura-shi, Fukuoka, Japan.

Biology. Of the 25 specimens recorded above, 19 were collected using artificial light or light traps, suggesting that *B. putoni* exhibits positive phototaxis. Twenty-three specimens were collected from grasslands in riverbeds (Figure 3C, D) or green spaces located on a university campus, which are similar to the habitats described by Larivière and Larochelle (2004). Only two localities of this species, Sasaguri-machi in Fukuoka Prefecture and Kamikoshiki-shima Island in Kagoshima Prefecture, are surrounded by forests. One of us (Y. Hisasue) observed adult individuals feeding on *Briza minor* L. (Poaceae) and *Polypogon fugax* Nees ex Steud. (Poaceae), as host plants in a laboratory experiment.

DISCUSSION

Brentiscerus putoni has also been recorded in Indonesia, Papua New Guinea, Australia, and New Zealand (White 1878; Slater 1964; Scudder 1967; Malipatil 1975; Malipatil 1977; Cassis and Gross 2002; Larivière and Larochelle 2004; Kondorosy 2013; Dellapé and Henry 2022). The discovery of *B. putoni* in Japan suggests that this species is more widespread in the Palearctic, Oriental, and Australian regions, since Kamikoshiki-shima Island, which is the southwesternmost locality of *B. putoni* in Japan, is approximately 5,000 km

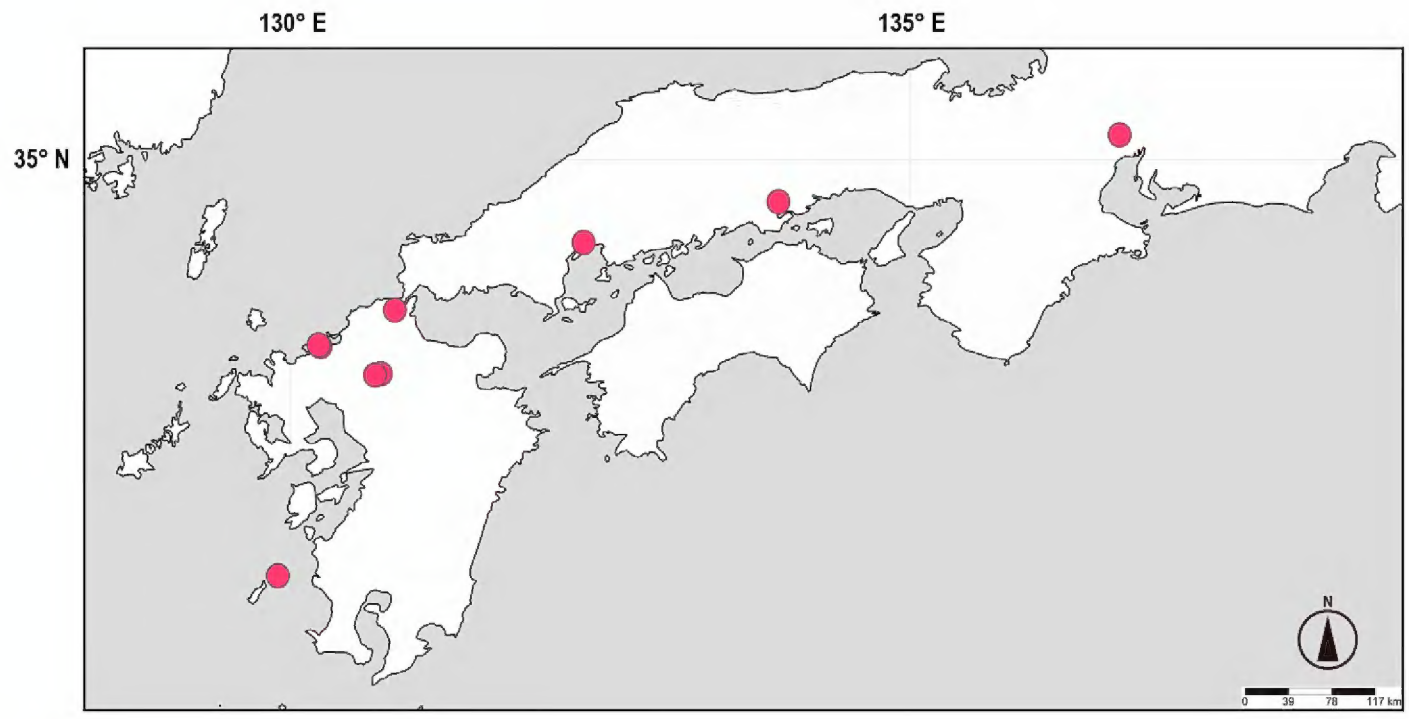

Figure Legends

Figure 4. Distribution map of *Brentiscerus putoni*: collection sites in Japan (red dots).

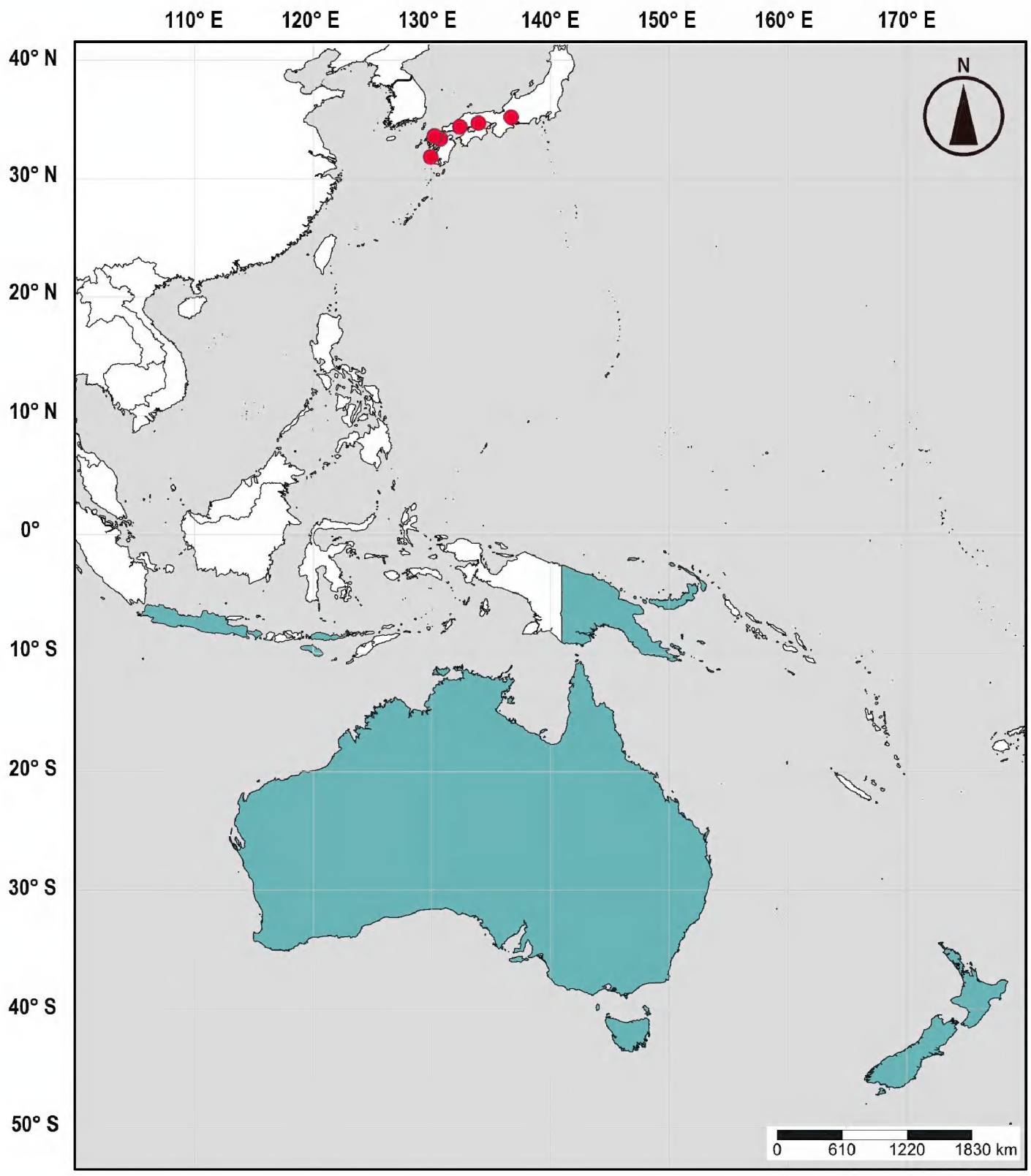

Figure 5. Distribution map of *Brentiscerus putoni*: known distribution (green-filled areas) and new records (red dots).

from the nearest known locality outside Japan (Figures 4, 5). Thus, many new localities may be found in future surveys from areas where no distribution records currently exist. However, in western Honshu and northern Kyushu, where the heteropteran fauna appears to be well investigated, many inventory lists and distribution records have been published (Morimoto et al. 1977; Saigusa et al. 1992; Kagoshima Prefectural Museum 1994; Okayama Prefecture 2003; Nomura et al. 2013; Nakamura 2014; Nozaki et al. 2015; Sawada

2018; Tanaka 2019; Iwasaki et al. 2020; Okayama Prefecture 2021), *B. putoni* has only been collected since 2013. Furthermore, of the 25 specimens recorded above, 24 were collected after 2019, and this species is common in the lowlands of northern Kyushu, which we (J. Souma and Y. Hisasue) have thoroughly investigated. Consequently, the Japanese population of *B. putoni* should be considered an alien species recently introduced by human activity rather than a widely distributed native species.

Brentiscerus putoni has been consistently collected for several years in Fukuoka-shi and Asakura-shi, northern Kyushu, and appears to occur continuously in these localities. Therefore, it is believed that this species is established in northern Kyushu since being initially introduced to Japan. Detailed studies on the occurrence of *B. putoni* in Japan are needed to verify this species' future distribution and its potential impacts on native ecosystems.

ACKNOWLEDGEMENTS

We express our sincere thanks to Hélcio R. Gil-Santana (Instituto Oswaldo Cruz, Rio de Janeiro, Brazil), Pablo M Dellapé (Museo de La Plata, La Plata, Argentina), Snejana Grozeva (Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia, Bulgaria), and Jader Oliveira (University of Sao Paulo, Sao Paulo, Brazil) for critical comments on the manuscript. We are grateful to Tomohide Ohno (Aichi, Japan), Hayato Bando (Hiroshima, Japan), Shigeru Okudera (Hokkaido University of Education), Shoichi Imasaka (Fukuoka, Japan), Natsumi Katsube (Kanagawa, Japan), and Reo Ito (Oita, Japan) for providing material used in this study. We are much indebted to Hiroki Moriwaki (Japan Wildlife Research Center) for identifying food plants of this species. The first author thanks Tsubasa Miyakawa (Kanagawa, Japan) for providing references. The third author thanks Kohei Nishiya (ELKU) for support in taking photographs of living habitus. This study was partially supported by KAKENHI (JP19K01147, head investigator: Ken'ichi Saiki; JP23K05911, head investigator: Teruaki Ban) to the first author, Grant-in-Aid for JSPS Fellows (JP20J20483) to the second author from the Japan Society for the Promotion of Science, Tokyo, Japan and JST SPRING (grant number: JPMJSP2136) to the third author from the Japan Science and Technology Agency, Saitama, Japan. We thank to Editage (http://www.editage.com) for English language editing.

ADDITIONAL INFORMATION

Conflict of interest

The authors declare [or author declares] that no competing interests exist.

Ethical statement

No ethical statement is reported.

Funding

This study was financially supported by the Japan Society for the Promotion of Science, Tokyo, Japan and the Japan Science and Technology Agency, Saitama, Japan.

Author contributions

Conceptualization: TB. Data curation: JS, YH. Funding acquisition: TB, JS, YH. Investigation: JS, YH. Methodology: TB, JS, YH. Project administration: TB, JS, YH. Resources: JS, YH. Software: TB. Supervision: TB. Validation: TB. Visualization: TB. Writing – original draft: TB. Writing – review and editing: TB, JS, YH.

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Data availability

All data that support the findings of this study are available in the main text.

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